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APPENDIX.

(The MSS. of the following papers were unfortunately mislaid, so that the titles only were printed in last year's "Proceedings.")

3. The Thermo-Electric Properties of Cobalt. By Messrs C. G. Knott, J. Gordon MacGregor, and C. Michie Smith.

(Read 5th June 1876.)

As we could not find pure cobalt for sale in the state of foil or wire suitable for thermo-electric experiments, we resolved to prepare it by electrolysis of chloride of cobalt in the way recommended by Mr G. W. Beardslee of Brooklyn, N.Y.* For this there is required pure chloride of cobalt of a certain strength to form the electrolyte, and spongy metallic cobalt to form the positive electrode. By the kindness of Dr Crum Brown these were prepared with very great care in the chemical laboratory by Mr Robinson, to whom we are much indebted. The following note of the method of preparation employed has been supplied by Mr Robinson:—

"Oxide of cobalt was dissolved by heat in hydrochloric acid; the acid solution was treated with ammonia in great excess, the precipitate at first formed being then dissolved; the ammoniacal solution of chloride of cobalt was then oxidised by passing clean, dry air through it till the colour was no longer altered, *i.e.*, till the purple colour was succeeded by a reddish-brown, and till it admitted of precipitation by hydrochloric acid. This was done.

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* *Les Mondes*, vol. xxxv. p. 206.

The precipitate purpureo-cobaltic chloride was collected on a filter, well washed with very dilute hydrochloric acid, and dried carefully, great care being taken to avoid contamination by iron. The dried purpureo-cobaltic chloride was then reduced in a current of hydrogen in small reducing crucibles, and fine skeletons of spongy cobalt were obtained. 26 gms. of cobalt were made in this way; the remainder of the purpureo-cobaltic chloride was heated to expel chloride of ammonium, dissolved in hydrochloric acid and water, and when evaporated to dryness, yielded 32 gms. of chloride of cobalt. This was made up to 900 c.c. with distilled water."

Having obtained these, some experiments were then made as to the substitution of aluminium for the carbon-electrode used by Mr Beardslee, and as to the strength of current required. The aluminium was found to answer admirably. These preliminary experiments over, we set about preparing such a bar as would serve us instead of a wire in our thermo-electric work. For this end we took a strip of aluminium about 100 mm. long, and 8 mm. broad, carefully covered it with wax on one side, and used it as the negative electrode. To form the positive electrode a piece of glass tube, 10 mm. wide, and 20 mm. long, was taken and closed at one end, through which a platinum wire was passed; the one end of this was connected with the positive pole of the battery, while the other end was coiled into a spiral inside the tube, into which some of the spongy cobalt was tightly packed so as to make good contact with the wire. These electrodes were placed in a porcelain bath containing some of the chloride of cobalt solution, rendered very slightly alkaline by the addition of ammonia. The battery found most suitable consisted of two large Bunsen cells; when less was used the deposition went on too slowly, while pieces prepared with a stronger battery-power were incoherent. The action was usually allowed to go on for two or three days, at the end of which time the metal had a considerable thickness. The cobalt was separated from the aluminium by boiling it in a strong solution of caustic soda. The pieces of cobalt thus prepared were of very great hardness and compactness, being with difficulty filed.

It was with these pieces of cobalt that the thermo-electric observations were made. The first observations showed that the cobalt line lay very far down on the thermo-electric diagram, while subsequent observations showed that it lay below all the lines formerly obtained. Hence it lies in a region in which it is very difficult accurately to determine its position. This difficulty is increased by the circumstance that the line which lies nearest it, namely, that of nickel, is not a straight line. Another difficulty in carrying out the experiments arose from the shortness of the cobalt bars, but this was in a great measure overcome by the use of a slight modification of the apparatus devised for the determination of the thermo-electric properties of sodium and potassium, formerly described to this Society.* The following is a brief account of the experiments and their results:—

In the beginning of March one of the bars was ready for use. Preliminary observations carried on with hot oil having shown that no marked peculiarities existed within the temperature of boiling oil, a quadruple junction of M, N,† nickel and cobalt was formed and heated by means of a red-hot iron cylinder. The nickel-cobalt deflections obtained from this experiment, when plotted in terms of the M-N deflections, gave a line showing clearly the nickel peculiarities, and supplied us with an approximate position for cobalt.

On the opening of the laboratory for the summer session experiments with the hot cylinder were resumed, and a quadruple junction of M, N, palladium, cobalt, was used. This was connected with the galvanometer in such a way that the deflections due to the thermo-electric pairs Pd-Co, M-N, M-Pd, could be read separately, and in rapid succession. The M-N junction supplied us with a temperature scale as in former experiments, and the lines got by plotting the other deflections in terms of this gave an easy method of fixing the relative positions of cobalt, palladium and M, and hence of fixing the position of cobalt on the thermo-electric diagram." Owing to the much greater electro-motive force in the Pd-Co and M-Pd circuits than in the M-N circuit, a resistance of 192 ohms had to be inserted between the palladium wire and the galvanometer. The M-Pd curve presented the usual well-known parabolic appearance without any marked peculiarity, but the Pd-Co curve, though parabolic at comparatively low temperatures, showed at the higher temperatures an apparent tendency to straighten, thus indicating a possible point of contrary-flexure, *i.e.*, a bend in the cobalt line at a temperature somewhere about or above a bright red heat. The approximate position of the cobalt line may be gathered from these facts: that the line of 15° C is divided by the points of intersection of the cobalt, palladium and M lines in the ratio of 11 : 8, and that the cobalt line is inclined to the horizontal at an angle not quite double of the angle of inclination of palladium.

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* Proc. Roy. Soc. Edin. 1873–4, p. 350.

† Trans. R. S. E. 1872–73, p. 138.

In experiments made to-day with a double circuit of Co-Pd against nickel, with some resistance thrown into the cobalt arm, a neutral point has been got at a temperature of about 500° F. This shows us that by the aid of cobalt we shall be able to investigate the peculiarities of nickel more accurately, while from the parts of the nickel line which are already known we shall be able to fix definitely the position of the cobalt. It is worthy of notice that even at the high temperatures of the red-hot or even white-hot cylinder the cobalt shows no tendency to oxidise.

Electric Conductivity.—During the last few days we have been carrying on a series of experiments on the change of the electric conductivity of cobalt with change of temperature. For this we prepared a very narrow strip of cobalt by depositing it on the edge of a piece of aluminium. To the ends of the strip so prepared stout copper wires were soldered, and the experiments were then carried on as in the case of nickel (Proc. Roy. Soc. Edin., 1875–6, p. 120). The line obtained was not straight but slightly curved, showing apparently a gradual alteration in the rate of change of conductivity. Within the temperature of boiling oil, however, there is no indication of a sudden change, and the curve in the line may be due to several disturbing causes which we have not as yet been able to eliminate.

5. Notice of some Recent Atmospheric Phenomena.

By Professor Tait.

(Read 5th June 1876.)

On March 25th, at 8.15 P.M., very few clouds being visible, there appeared a luminous arch in a vertical plane, passing *true* E. and W. nearly through the zenith. This arch, to my surprise, gave everywhere a continuous spectrum. I had, in company with Professor Dewar, observed a phenomenon similar in all respects (continuous spectrum included) some seven years before, and was then inclined to fancy the arch a mere low-lying cloud, and its light due to the town lamps. But on the present occasion, after about forty minutes, when the arch had disappeared, an aurora, showing unmistakably in the spectroscope the characteristic green band, appeared near the magnetic north. And a few days afterwards there appeared in the Edinburgh newspapers several descriptions of a similar arch seen at almost exactly the same time at Colinton, &c., and even so far off as Dunfermline. Most of the observers remarked the entire absence of coruscations as a proof that the phenomenon could not be auroral. The facts stated seem, however, to leave no doubt that it was connected with the aurora, and the peculiarity of its spectrum remains to be explained.

On May 10th, the sky cloudless but hazy, from 11 A.M. till nearly 3 P.M., I observed a magnificent halo of 22°, with its tangent arcs forming almost a complete external oval. Various observers in different parts of Scotland seem to have noticed the halo itself from 2 P.M. till sunset, but none have mentioned the external oval, which at midday was brighter than the halo.

As showing that the ice-crystals in the air were very widely spread about this period, I append an extract from a letter I have just received from Mr Aitken of Darroch.

"I have sent you a sketch I made of an atmospheric phenomenon which I saw at Cadenabbia, Lago di Como, on Sunday the 30th April, and hope it may be useful to you to-night.

"The weather during the previous day was very bad; it rained heavily all day. The wind was northerly, and the temperature low. In the evening there was a thunderstorm, accompanied by a good deal of lightning. Sunday morning broke clear and fine;

without a cloud in the sky, almost no wind, and barometer high. At 10.45 A.M., when I first noticed the phenomenon, the sky was covered with a very thin uniform white haze, and no clouds visible.

"When first observed, the large circle which passed through the sun was complete, but only the upper half of the small circle which surrounded the sun was visible. There was no colour in the large circle, but the small circle was fringed with colour, the outside being of a bluish-violet tint, the inside reddish. In the centre of the band, between the two colours, no colour could be distinguished; it looked pure white. On each side of the small circle there was a short strip of colour, cutting the large circle at an acute angle. This short band was visible on the white band of the large circle, and only extended to a short distance on each side of it. The small coloured circle was never very perfect, only the top part remained steadily brilliant, and at this part the colours were more brilliant than at any other part. The sides were particularly always rather undefined.

"For part of the time, while the phenomenon lasted, there was an extraordinary change in its appearance. There appeared to be two circles of nearly the same diameter surrounding the sun, neither of which was concentric with the sun, and were separated from each other horizontally, as shown in the lower of the two sketches. While this was the case the circles were never complete, only little more than the upper halves of them being visible. Another curious point was that the coloured circle did not seem a perfect circle. The horizontal axis seemed longer than the vertical; but of this I am not certain, as I had no instruments to take any measurements. The only means of observation I had was a circular piece of paper I hurriedly cut, and held between my eye and the sun, in such a position that the sun shone through a small hole in the centre. When this disc was held at such a distance from the eye that the upper part of the coloured circle was just seen past the edge, the lower part and the sides were seen to project some distance beyond it.

"About 11.5 A.M. the haze began to collect into clouds, and the phenomenon ended at 11.20. As the day advanced, clouds continued to form, and rain began to descend at 2 P.M. Towards evening it became very wet, and it continued to rain every day for more than a week."

1. On New and Little-known Fossil Fishes from the Edinburgh District. No. III. By R. H. Traquair, M.D., F.G.S.

(Read 7th May 1877.)

Elonichthys ovatus, sp. nov. Traquair.

Of this I have only seen one specimen, from the limestone of Burdiehouse, and preserved in the Edinburgh Museum of Science and Art.

Description.—Allowing for the anterior part of the head, which is deficient, the entire length of the specimen to the extreme point of the upper lobe of the caudal fin would be about 5⅝ inches; the greatest depth of the body in front of the dorsal fin is 1½ inch. The distance from the origin of the pectoral fin to that of the ventral is a little over 1 inch, to opposite the commencement of the dorsal 1¼ inch, to opposite that of the anal 1½ inch, and to opposite that of the lower lobe of the caudal nearly 3 inches. The general form of the fish is thus remarkably short, deep, and ovoid, and its general appearance does not indicate that its peculiar form is due to *post mortem* distortion or change.

Nothing can be said regarding the osteology of the head, which is hopelessly crushed, and its anterior part cut off by the edge of the stone. The scales are of moderate size, and ornamented externally, like those of *E. striolatus*, with delicate punctures and oblique furrows, the latter mostly observable towards the anterior margins. The paired fins are small, the pectorals only equalling ¾ inch in length, the ventrals being a little shorter; the median fins, on the other hand, are very largely developed. The dorsal and anal fins contain about 35 rays each, as nearly as can be ascertained. The former fin is the larger, and is very high and acuminate in front, the length of its longest ray being 1½ inch, while its base equals 1 inch in extent. The anal fin commences opposite the posterior third of the dorsal; it is not so acutely pointed, for while the length of its base is, as in the dorsal, 1 inch, that of its longest rays is the same; its posterior margin is also a little more concave. The principal rays of these two fins have their transverse joints rather longer than they are broad. As usual, they begin to dichotomise towards their extremities; this process, however, occurs proportionally sooner in the shorter rays behind. The caudal is very powerful;

inequilobate. The anterior rays of the lower lobe have, for a considerable extent of their length, their transverse articulations more distant than those of its other rays and of the whole upper lobe, in which the joints are very short.

Remarks.—This species closely resembles *E. striolatus*, but is distinguishable from it by the very short and deep form of the body, and the more largely developed median fins, of which the dorsal is especially striking, from its great size. Although fully aware of the danger, in dealing with Palæozoic fishes, of defining or founding species upon proportional measurements, yet, seeing that, as already observed, there seems to be no evidence that the present specimen has undergone any material change of form by *post mortem* processes, I have, after due consideration, thought it best to bestow upon it a new specific designation.

Geological Position and Locality.—From Burdiehouse, in limestone of the calciferous sandstone series.

Elonichthys Bucklandi, Agass. sp.

Pygopterus Bucklandi, Agassiz, "Poissons Fossiles," vol ii. pt. 2, p. 77 (1835).
,, ,, Hibbert (Agassiz), Trans. Roy. Soc. Ed., vol. xiii. pp. 216–217, pl. vii. fig. 2 (1834–35).

I have not seen the original type of this species, figured by Dr Hibbert in his celebrated memoir on the Burdiehouse limestone, and stated by Agassiz to be in the collection of the Royal Society of Edinburgh. This may, indeed, have been a mistake, and the specimen may possibly have been in the private collection of Dr Hibbert, now unfortunately dispersed. From Hibbert's figure, however, and the very brief notice of this species in the "Poissons Fossiles," I feel pretty confident in referring to it a number of mostly fragmentary remains of a large Palæoniscoid fish from Burdiehouse contained in the Edinburgh Museum of Science and Art.

The only entire specimen I have seen is 11½ inches in length. It is, most unfortunately, crushed on its back. It displays, however, the right pectoral and ventral fins. The former has its principal rays articulated throughout; the ventral is of moderate size. The median fins are large. The dorsal is not shown in any of the specimens belonging to the Edinburgh Museum, but in Dr Hibbert's figure it is seen to resemble the anal, and is evidently placed nearly opposite the interval between that fin and the ventrals, although the latter are not shown in the figure. The anal is, however, well shown in one specimen; it is large, triangular, and acuminate, and is closely followed by the caudal, which is very powerful. The fin rays are externally ganoid and finely striated; their transverse articulations are very close; the fulcra are closely set, and minute for the size of the fish. The scales of the body are proportionally small. Those of the front part of the body are apparently nearly equilateral, but posteriorly, and more especially towards the ventral margin, their form is low and narrow. Their anterior covered area is very narrow; the posterior margin is very finely denticulated. The exposed area is covered with a delicate yet sharply-defined ornamentation, consisting of fine sub-parallel ridges which pass from before backwards across the scale in a gently sigmoid direction, tending to become intermixed with punctures posteriorly, especially above the diagonal between the two acute angles of the scale. Towards the tail the ridges become less marked on the posterior part of the scale, giving way to the thickly dotted punctures, till, on the caudal body-prolongation, the former, after lingering at the anterior margin, altogether disappear, and punctures alone remain.

Very little can be made out concerning the bones of the head; however, in the above mentioned entire specimen the lower jaw is seen to be very stout, and ornamented externally with fine, sharp, closely set, wavy, branching, and anastomosing and interrupted ridges running in a longitudinal direction. The laniary teeth are very strong, incurved, and smooth, with apical enamel cap; similar teeth are seen on the maxilla, the dental margin of which is finely tuberculated.

Remarks.—The structure of the pectoral fin, the relative position of the dorsal and anal fins, and the form of the latter, show clearly that this species is not a "*Pygopterus*," to which genus it was referred by Agassiz. On the other hand, its affinities to *Elonichthys striolatus* are unmistakable, though it attains a larger size. In this and in some other respects it resembles considerably the three large species from the Coal-measures of North Staffordshire, which I have recently described as *Elonichthys semistriatus*, *caudalis*, and *oblongus*.*

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*Memoirs of the Palaeontographical Society for 1877, "Carboniferous Ganoids," pp. 49-57.

Elonichthys (?) *pectinatus*, sp. nov. Traquair.

Description.—Flank scales about $\frac{1}{3}$ inch broad, and usually a little higher, exclusive of the articular spine; moderately thick. Upper margin with prominent articular spine; anterior covered area narrow; exposed surface brilliantly ganoid, sculptured with oblique, sub-parallel, prominent ridges, occasionally branching, anastomising, and intercalated, and terminating behind in delicate denticulations of the posterior margin; about 7 or 8 of these ridges in the space of $\frac{1}{8}$ inch. Under surface of scale with feebly marked keel; a narrow area along the posterior margin is obliquely grooved, the short grooves terminating between the denticulations of the margin, so as to produce a pectinated appearance. Scales from apparently the ventral aspect are lower than broad, and with more produced anterior-superior angles; others, from their more regularly rhomboidal shape, and scanty development or absence of the articular spine, and more prominent keel of the attached surface, were probably situated more towards the caudal extremity. In all cases the external sculpture is similar, and the under surface displays the same peculiar pectinated appearance at the posterior margin.

Associated with these scales there is on a specimen from Carluke in the collection of Mr Grossart, of Salsburgh, a small fragment of the edge of what must have been a pretty large jaw. This fragment is nearly $1\frac{1}{2}$ inch in length, and displays the stumps of 5 stout conical teeth, with traces of smaller ones external to them; the external surface of the bone is beautifully tuberculated.

Remarks.—Though as yet I only know this species from detached and dislocated scales, often occurring together in masses, and, from the small jaw fragment described above, there can be no doubt as to its distinctness and novelty as a species. In external sculpture these scales bear a considerable resemblance to those of *Acrolepis Rankinei* (*Gyrolepis Rankinei*, Ag.), with which, on superficial examination, they might perhaps be confounded, but from the latter they may be at once distinguished by the narrowness of the anterior covered marginal area, and the grooved pectination of the posterior margin of the internal aspect. Of course, until further information regarding its fins and head be obtained there must be some uncertainty as to the genus to which it belongs. Meanwhile, I have assigned this species to *Elonichthys* on account of the general configuration of the scales. Should this opinion prove correct, it is certainly the largest species of the genus hitherto described.

Geological Position and Localities.—In the blackband ironstone of Gilmerton belonging to the Lower Carboniferous Limestone series; in bituminous shale from a similar horizon at Carluke, in the collections of Dr Rankin of Carluke, and Mr Grossart of Salsburgh; in calcareous shale accompanying the limestone of Levenseat in the Upper Carboniferous Limestone group. I am indebted to Mr Grossart for specimens from the last-named locality.

Rhadinichthys, gen. nov. Traquair.

Palæoniscus (pars), Agassiz.

Body more or less elongated; scales moderate, sometimes rather large, variously ornamented or nearly smooth, their posterior margins serrated. Caudal body prolongation slender. Dorsal fin placed rather far back, commencing only very slightly in front of the anal; the principal rays of the pectoral unarticulated till towards their terminations. Suspensorium very oblique; gape very wide; jaws armed with a row of incurved conical laniaries, outside which there is a series of smaller teeth.

I propose to institute the genus *Rhadinichthys* (ῥαδινός, slender, and ἰχθύς) for the *Palæoniscus ornatissimus* of Agassiz, and a number of other species from carboniferous rocks, many of which have hitherto been undescribed. These fishes differ markedly from *Palæoniscus* in the structure of the pectoral and in the position of the dorsal fin, in these respects approaching *Pygopterus*, from which they are, however, distinguished by their scales being proportionally larger and thicker, the anal fin not being prolonged backwards in a fringe-like manner, and the caudal body prolongation being much less powerful. None of the species of *Rhadinichthys* attain large dimensions; most of them are, indeed, fishes of very small size.

This genus is, so far as is yet known, confined to the carboniferous formation, and is abundantly represented in rocks of that age in Great Britain. Judging from the figures given, *Palæoniscus Cairnsii* of Jackson, and some of the other small Palæoniscidæ from

New Brunswick figured but not named by him,* seem to be referable to *Rhadinichthys*, as is possibly also the case with his *Palæoniscus Albertii*, though I regret that I have not seen any specimens of the latter sufficiently perfect to enable me to come to a definite conclusion as to whether or not it may belong to still another genus—most certainly, however, it is not a "*Palæoniscus*" in the sense in which that term ought now to be restricted.

Rhadinichthys ornatissimus, Agass. sp.

Palæoniscus ornatissimus (pars), Agassiz, "Poissons Foss." vol. ii. pt. ii. pp. 92–93 (1835); "Atlas," vol. ii. pl. 10*a*, fig. 6, *but not* figs. 5 and 7.

"*Palæoniscus*" *ornatissimus* was described by Agassiz from three specimens, all of which are figured in the "Poissons Fossiles." Two of these from Burdiehouse are in the collection of the Royal Society of Edinburgh; they are in a very bad state of preservation, nevertheless enough is seen of their structure to convince me that they belong to two different species. The original of fig. 5, tab. 10*a* ("Atlas," vol. ii.), seems to me to be only a peculiarly crushed specimen of *Elonichthys Robisoni*. The other, represented in fig. 6, is of larger dimensions, and though the fins are very imperfectly shown, yet, from the general form of the body, and from the sculpture of the scales and cranial bones, I have no hesitation in identifying with it a number of specimens of a fish, which is not uncommon in the rocks of the calciferous sandstone series of the neighbourhood of Edinburgh. The specimen represented in fig. 7 of the same plate of Agassiz's work does not seem to me to belong to the same species, and, unfortunately, there seems now to be little hope of tracing the original to its present possessor, as it belonged to the late Mr Jamieson Torrie, whose collection was, after his death many years ago, sold by public auction and dispersed. As type of "*ornatissimus*" we are therefore justified in taking the original of fig. 6 of the plate referred to.

Description.—The length of the type specimen, which is so bent round that the tip of the tail nearly touches the snout, is 5 inches; doubtless, its original length was greater, previous to the strange contortion which has thus affected its form. It is, nevertheless, small, the most perfect specimen in the Hugh Miller Collection attaining a length of 8 inches, while another, unfortunately wanting the head, would probably have measured no less than 10 inches had it been entire. The head seems rather large, and would probably be contained about $\frac{1}{5}$ in the total; the greatest depth of the body is at the shoulder, whence it gradually tapers to the tail pedicle, which is rather narrow. The suspensorium is very oblique, the gape extensive; the lower jaw is of a tapering form. Traces of sharp conical teeth are seen in many specimens, and are, as usual, arranged in two sets—internal larger and external smaller. The operculum is large and oblong, with acute anterior-superior and posterior-inferior angles; the interoperculum is of the usual quadrate shape. A specimen from Wardie, obliquely compressed upon its back, shows on the right side a beautiful series of 15 branchiostegal rays, along with the anterior 7 of those of the other side, besides which there is a small median lozenge-shaped plate behind the symphysis of the jaw, the anterior plate of each lateral series being also much broader than the others. All the bones of the head are finely and closely striated.

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* Report on the Albert Coal Mine, New Brunswick.

The scales are rather large on the front of the flank. In a Burdiehouse specimen, which probably measured originally about 10 inches in length, one of these scales measures $\frac{2}{5}$ inch in height by $\frac{3}{10}$ in breadth; they get much smaller posteriorly, and those situated on the belly are rather low and narrow. Their external ornament consists of sharp yet delicate slightly sigmoidally curved ridges, mostly parallel with the superior and inferior margins. In the furrows between these, numerous punctures may be observed, and very often about the centre of the scale the ridges are over a small space nearly obsolete, so that the punctures come more prominently into view. Proceeding towards the tail, the ridges become less and less prominent, especially in the middle of the scale, so that the ornament ultimately appears to consist only of short furrows and punctures, which are most marked towards the anterior and posterior margins. The posterior margin of the scale is finely denticulated; the keel of the under surface is feebly marked in the scales of the front of the body, but posteriorly it becomes more apparent.

The paired fins are rather small, the pectoral attaining only about one-half the length of the head. It consists of about 30 rays, of which the principal ones are, as in *Pygopterus* and *Oxygnathus*, unarticulated till towards their terminations. The ventrals are not well exhibited in any of the specimens, though in two cases portions of them are seen; they seem to have been small, with delicate rays, whose transverse articulations are rather distant. The dorsal and anal fins are moderate, the former being placed far back, and arising only slightly in front of the anal. Both are acuminate, triangular, with considerable concave posterior margins. The base of the anal is slightly more extended than that of the dorsal, and a well-marked interval occurs between its termination and the commencement of the caudal. It is not possible to ascertain the number of rays in those fins. They are rather delicate, and with their transverse joints about twice as long as broad—at least, in the longer rays before bifurcation. When the rays are *in situ* their articulations appear proportionally still more distant, owing to the usual imbrication of the demi-rays. The anterior rays of the lower lobe of the caudal are stouter than those of the rest of the fin, and have their transverse articulations closer, the joints appearing nearly square as seen from the outside; as the lower lobe passes into the upper one the rays become more delicate, and their articulations more distant. The outer surfaces of the rays of the pectoral are nowhere seen, but in the other fins the rays are ganoid externally, and mostly smooth, though showing here and there, especially towards their proximal extremities, traces of longitudinal striation. The fulcra are small, though very distinctly visible under an ordinary lens.

Geological Position and Localities.—The specimens which I have included under the foregoing description are all from the Calciferous Sandstone series of Midlothian, in which the species seems to be widely distributed, though not very abundant as regards number of specimens. It occurs in the Wardie shales, at Wardie (Museum of Science and Art and collection of the author); near Slateford (collection of the Geological Survey of Scotland); near Juniper Green (Mr John Henderson); in the horizon of the Burdiehouse limestone, at Burdiehouse and at South Queensferry. Its occurrence in strata of similar age in Fifeshire is extremely probable, though the specimen from Burntisland, figured as *Palæoniscus ornatissimus* by Agassiz, seems now to be unfortunately lost.

Rhadinichthys ferox, sp. nov. Traquair.

Of this new species there is one tolerably entire example from Wardie in the Hugh Miller Collection in the Edinburgh Museum of Science and Art. A short time ago also the Museum acquired a fragment of the head and anterior part of the body, collected by Mr C. W. Peach, and quite recently another fragment, a portion of the body, was presented by Mr David Grieve. In the following description these specimens will be referred to as Nos. 1, 2, and 3 respectively.

Description.—The specimen in the Hugh Miller Collection has undergone a twist about the middle of the body, and shows, moreover, only a portion of the caudal fin, so that it is difficult to estimate its original length. As it is, it measures 5¾ inches in length, but it is quite evident that when alive it must have been considerably longer.

The head equals 1¾ inch in length, and shows superiorly a cast of the greater part of the inner surface of the cranial buckler, with the lines of demarcation between the parietal, frontal, squamosal, and post-frontal bones. The opercular bones are not seen, but a portion of the maxilla, and the greater part of the mandible are exhibited, the latter bearing sharp conical teeth of different sizes, those externally placed being very small, while one large laniary, $\frac{1}{10}$ inch in length, is conspicuous. In specimen No. 2 the impressions are seen of the parietal, squamosal, opercular, præopercular, post-temporal, and supra-clavicular bones, and of the posterior part of the maxilla, these impressions clearly showing that the external sculpture of the bones in question was of a highly ornate character, consisting of sharply defined, flexuous, branching, anastomising, and interrupted ridges, tending to pass into tubercles at the inner margin of each parietal.

The scales are of moderate size on the flanks, becoming rather small posteriorly, while on the belly they are low and narrow. Over the whole body their outer surfaces are highly ornate, the ornamentation consisting of fine sharply defined ridges, forming a pattern which is usually, as it were, divided by a diagonal passing from the anterior-superior to the posterior-inferior angle of the scale. On the anterior-inferior half of the scale the ridges run parallel with the anterior and inferior margins, impinging posteriorly on the diagonal, while on the posterior-superior half they pass obliquely downwards and backwards, mostly parallel with the diagonal, ending in the denticulations of the posterior margin; in many cases they are interrupted before reaching that margin, and are replaced by other shorter ones springing up between them. In some cases, also, a few of the ridges of the upper half, near the anterior-superior angle of the scale, likewise impinge upon the diagonal, consequently meeting those of the lower half at acute angles.

The pectoral fin is well displayed in specimen No. 1, in which it measures rather more than 1 inch in length. It is of considerable expanse, and consists of at least 30 rays, of which the stronger ones, the first 15 counting from the lateral margin, are unarticulated till towards their terminations, where bifurcation sets in. The ventrals are not shown. Portion of the dorsal is seen in No. 1, in which it seems to arise opposite the anterior part of the anal, and its entire contour is exhibited in No. 3. It is triangular and acuminate, very high in front; its rays, which cannot be counted, are rather delicate, and their transverse articulations considerably distant. In No. 1 the anal is seen to be of large size, and of the same triangular acuminate form as the dorsal. Its base is $1\frac{1}{10}$ inch in extent, and its longer anterior rays seem to have exceeded that measurement, though they are cut off at the apex; the fin is, moreover, badly preserved, and its anterior margin somewhat distorted and injured. In the same specimen the origin of the lower lobe of the caudal is also shown, consisting of exceedingly closely set deeply imbricating rays, of which I count at least 40 up to where they begin to pass into those of the upper lobe, but here the tail is unfortunately truncated by the edge of the nodule. Interspinous bones of great strength are seen supporting this part of the caudal fin.

Remarks.—This is a most distinctly-marked species, differing obviously from *R. ornatissimus* in the proportions and sculpture of the scales, and in the large size of the fins. I know of no other species with which it can at all be confounded. The first time I saw the most perfect of the three specimens described above, I was struck with the general resemblance which it bore to the Permian genus *Pygopterus*, but the larger proportional size of the scales, and the anal fin not being prolonged backwards, indicate that its place is in *Rhadinichthys*.

Geological Position and Locality.—In ironstone nodules from the shales of Wardie, near Edinburgh, belonging to the Calciferous Sandstone series.

Rhadinichthys lepturus, sp. nov. Traquair.

I am indebted to Dr Paterson, of Leith, and to Mr R. Etheridge, jun., for the loan of two specimens of a small *Rhadinichthys* from Grange Quarry, Burntisland, which appears to belong to a new species. With these I can identify a detached tail recently found by myself in the same locality.

Description.—The length of Dr Paterson's specimen is $3\frac{1}{2}$ inches, allowing for the extremity of the snout, which is deficient. The depth of the body, midway between the head and the dorsal fin, is $\frac{11}{12}$ inch; that of the tail pedicle at the commencement of the lower lobe of the caudal is $\frac{7}{24}$ inch. It is, however, just possible that the anterior part of the fish may be a little shortened up by one of the common forms of distortion, as, on the other hand, the whole shape of the other specimen belonging to Mr Etheridge certainly is unnaturally attenuated by a similar cause. Nevertheless, we have before us a small fish of a fusiform shape, elegantly tapering posteriorly to a very narrow tail pedicle, the dorsal and anal fins being nearly opposite each other, and a well-marked interval occurring between the latter and the commencement of the caudal, which is rather small and of a delicate appearance. Nothing can be said regarding the head, which is hopelessly crushed. The scales are of medium size, becoming rapidly smaller posteriorly. Those of the anterior part of the body have their outer surfaces entirely covered by a delicate sculpture consisting of fine furrows and ridges passing across the scale, and ending in the denticulations of the posterior margin, those of the upper and posterior part of the area being more oblique than those of the lower and anterior. On the posterior part of the fish the scales are seen only from their inner or attached surfaces. The origin of the pectoral fin is seen in the second specimen referred to, but it is in very bad preservation. Returning to Dr Paterson's specimen, a few rays of the ventral are seen, but the real size and shape of the fin are not shown. The dorsal and anal fins are moderate, and of the same form, triangular, concavely cut out behind, with delicate rays, whose transverse joints are considerably longer than they are broad. The dorsal commences only very slightly in front of the origin of the anal, and an interval, equal to $\frac{2}{3}$ the length of the base of the anal, occurs between its posterior termination and the commencement of the lower lobe of the caudal.

The last-named fin is unusually delicate in appearance, the upper lobe only very slightly exceeding the lower in length, with a slender body prolongation. In the lower lobe the transverse joints of the principal rays are longer than they are broad, except just towards their terminations.

Remarks.—In the contour at least of the hinder part of the body this species strongly resembles *R. carinatus*, save that the caudal fin is more delicate—the greater apparent depth of the body in front of the dorsal fin may be, as already indicated, perhaps accounted for by *post mortem* distortion. The sculpture of the scales, which is very different from what we find in *R. carinatus*, reminds us of *R. ornatissimus*, from which, however, the present species is obviously distinguished by the greater delicacy of the rays of the lower lobe of the caudal, with their more distant transverse articulations, as well as the entire aspect of the fin. It is, however, very possible that the imperfect specimen from Burntisland referred by Agassiz to "*Palæoniscus*" *ornatissimus* (Poisson's "Fossiles Atlas," vol. ii. pl. 10*a*, fig. 7), and in which the tail is deficient, may belong to *R. lepturus*, but his figure being by no means good, it is impossible to decide, in the absence of the original specimen.

Geological Position and Locality.—In calcareous shale overlying the "Burdiehouse" limestone exposed in Grange Quarry, Burntisland (Calciferous Sandstone series).

Rhadinichthys Geikiei, sp. nov. Traquair.

Through the kindness of Professors Ramsay and Geikie I have enjoyed the opportunity of examining a number of small specimens of Palæoniscidæ collected by the Geological Survey from the horizon of the Wardie shales near Redhall, among which there is at least one beautiful little species of *Rhadinichthys* hitherto undescribed. This I have much pleasure in dedicating to Professor Geikie, to whom I am much indebted for cordial assistance in prosecuting the study of Scottish Palæozoic ichthyology.

Description.—The specimens are rather fragmentary, except two in which the entire fish is shown. Of these the larger has undergone an unfortunate twist, but its length may be estimated at 3¼ inches; the other, measuring only 2⅛ inches, seems to me to be a younger example of the same species. The body is fusiform, the head rather large, being contained about 4 times in the total. The cranial bones are beautifully ornamented with delicate wavy ridges, running mostly in a longitudinal direction. The jaws are armed with sharp conical teeth of different sizes. The scales are of moderate size, gradually diminishing posteriorly, though those on the flanks are not of specially large dimensions. The flank scales are nearly equilateral in shape; the free surface of each is ornamented with 5 or 6 pretty well-marked oblique ridges, running downwards and backwards, and terminating in the denticulations of the posterior margin. Below there are a few more delicate striæ parallel with the lower margin. Along the back, between the head and the dorsal fin, the scales are smaller, and the ornamentation takes the form of a few sharply-marked striæ passing diagonally across the scale between the two acute angles. Posteriorly, as the scales become smaller, the ridges are fewer, and the ornamentation becomes more and more feebly marked, till on the tail pedicle the scales are nearly smooth, and entirely so on the caudal body prolongation, which is delicate. Some amount of individual variation occurs in the scales of different specimens, which I see no good reason for referring to different species. In two fragments representing portions of rather larger fishes than the rest, the scales of the back, between the head and the dorsal fin, are rather smoother, while those of the flank show a greater number of ridges and denticulations of the hinder margin; on the other hand, in the smallest specimen of the series, the ridging on the dorsal scales is very well marked, and rather feeble in those of the flanks.

The pectoral fin is shown in one specimen, but not well, being a little obscured by a thin film of the matrix; the ventrals are visible in none. The dorsal and anal fins are situated nearly opposite each other, the anal commencing only a little further back. The entire contour of these fins is not clearly exhibited, but their rays are smooth, delicate, and slender, with distant transverse articulations. The caudal is inequilobate, its rays are likewise delicate and smooth, and with distant articulations; the caudal body prolongation is slender.

Remarks.—In its general proportions *R. Geikiei* is not so slender as most species of the genus, and there is not the usual interval between the anal and caudal fins; in these respects it agrees with

R brevis, from which it may, however, be distinguished by the nature of the ornamentation on the scales and cranial roof bones.

Geological Position and Locality. From the Wardie shales in the Calciferous Sandstone series. The specimens were collected by Mr James Bennie, of the Geological Survey of Scotland, in a very fissile shale exposed near Redhall, to the west of Edinburgh, in a cutting made for the Caledonian Railway loop line to Juniper Green and Midcalder.

Rhadinichthys brevis, sp. nov. Traquair.

Description.—The length of the most perfect specimen in my collection is 3½ inches; the extremity of the caudal fin is not, however, preserved. Another specimen, more badly preserved posteriorly, must have been a little longer, judging from the size of the head and body. The head is elegantly shaped, with bluntly pointed muzzle. The opercular bones are rather small; the jaws pretty stout; the dentition is not visible. The bones of the cranial roof are sculptured, with contorted and rather flattened rugæ; those of the face are ornamented with sharp and closely set wavy ridges, which, on the operculum, pass obliquely downwards and backwards over its surface. The scales are of moderate, indeed, rather small size, and though, of course, diminishing gradually towards the tail, those in the flanks are not marked by any very special excess in size. The flank scales are nearly equilateral; the posterior margin of each shows 5 or 6 prominent oblique denticulations; the outer surface shows a few feebly marked, nearly obsolete ridges, passing obliquely backwards and a little downwards, and not very regularly placed. Immediately behind the clavicle, and above the origin of the pectoral fin, the sculpture is, however, more strongly pronounced, the ridges being finer, sharper, and closer together, but posteriorly the scales soon become nearly quite smooth. The paired fins are rather small, the principal rays of the pectoral are clearly seen to be unarticulated till towards their terminations; the ventrals are situated midway between the pectorals and the origin of the anal, their rays are delicate, and their transverse joints appear at least three times as long as broad. The dorsal and anal fins are large, and situated nearly opposite each other, the former commencing, as usual in this genus, slightly in front of the latter. Both have the same form, being high and acuminate in front, and concavely cut out behind; their rays are rather coarser than those of the ventrals, and their transverse joints are considerably longer than broad. In no case is the caudal fin well preserved, its rays being more or less disjointed and broken up, but it is clear that the prolongation of the body in the upper lobe was delicate, the rays slender, and with distant articulations.

Remarks.—As already indicated, this species agrees with *R. Geikiei* in the general form of the body, and, along with it, differs from all the other species of the genus with which I am acquainted in the closer approximation of the anal fin to the caudal; in both, also, the flank scales are comparatively small. But the action of the scale sculpture is essentially different. In *R. brevis* such ridges as are seen on the flank scales have not the same short, sharp, straight, and parallel character which distinguishes those which in *R. Geikiei* pass to the denticulations of the posterior margin; the rugæ ornamenting the cranial roof bones are also coarser, more flattened, and less capable of being described as "striæ."

Geological Position and Localities..—From the Calciferous Sandstone series. Five specimens are in my possession, four of which are in ironstone nodules from Wardie beach; the fifth I found in a detached block of slaty carbonaceous ironstone, on the shore near the mouth of the Kenly Burn, between St Andrews and Kingsbarns.

Rhadinichthys carinatus, Agassiz sp.

Palæoniscus carinatus, Agassiz; "Poissons Fossiles," vol. ii. pt. i. p. 104 (1835); "Atlas," vol. ii. tab. 4*b*, figs. 1 and 2.

The form of the body is slender, the length of the head being contained about 4¾ times in the total up to the bifurcation of the caudal fin, and equalling the greatest depth of the body at the origin of the ventral fins. The head is very elegantly shaped, rather depressed above, but pointed when seen in profile. The bones of the cranial shield are ornamented with sharp, delicate, wavy ridges or "striæ." A specimen from Wardie in my collection shows most clearly the presence of extensive ossification in the periotic and alisphenoid regions of the cranium, and, moreover, a cast of the posterior semi-circular canal of the ear is most distinctly and beautifully preserved. The opercular bones are rather small; the jaws remarkably slender and delicate; the external ornament of the facial bones consists, like that of the cranial shield, of delicate wavy ridges. No specimen I have as yet seen affords, however, the smallest trace of teeth. The paired fins are rather small. The pectoral is in no case well preserved, but there is sufficient evidence that its longer rays were not articulated till towards their terminations. The ventrals are still smaller, and are equidistant in position between the pectorals and the commencement of the anal. The median fins are, on the contrary, rather large in proportion to the size of the fish. The anal commences rather in front of a point equidistant between the origin of the ventrals and that of the lower lobe of the caudal; it is high and acuminate in front, and pretty deeply cut out behind; the length of its base is equal to that of its longest rays. The dorsal is similar in shape to the anal, and commences only slightly in front of the origin of the latter. The caudal is pretty large, and deeply cleft, the body prolongation along the upper lobe being, however, comparatively delicate. The rays of all these fins are slender, ganoid, and smooth externally; their articulations tolerably distant; the fulcra on their anterior margins obvious, though minute.

The scales are remarkable for their large size on the flanks, while on the belly they suddenly became very low and narrow; they diminish rapidly in size posteriorly, and on the tail pedicle are rather small. Externally they are brilliantly polished and nearly smooth; on the flank scales, however, a few shallow furrows extend a little way forwards from the posterior margin, which is, as usual, sharply denticulated.

Remarks.—The original specimen, collected by Lord Greenock at Wardie, and figured by Agassiz, is in the collection of the Royal Society of Edinburgh. It is very imperfect, showing no fins save the mere origins of the anal and caudal, the former of which seems to have been overlooked by Agassiz. On the other hand, I cannot, by the most careful examination, verify his statement regarding the presence of small teeth, "*en brosse*" upon the jaw. I am indebted to Professor Turner for the loan of a specimen from Cornceres, in Fifeshire, which belonged to the late Professor Goodsir; it is possible that this may be the "*Catopterus fusiformis*" which Mr

Robert Walker states was described by Professor Goodsir in 1838 before a meeting of the Literary and Philosophical Society of St Andrews, and which, according to Mr Walker, he characterised as closely allied to *Palæoniscus*, but differing from it "in wanting the scaling or false rays along the anterior ray of the fins, and also in the dorsal fin being opposite the anal."* In this specimen the dorsal is, indeed, nearly opposite the anal (as in others of the same genus as well as species), but, on close examination, fulcra are distinctly observable. I have not been able to obtain Professor Goodsir's description, or even to ascertain exactly where it is to be found, but as it appears to have been published only in a provincial newspaper, the generic name *Catopterus* must remain with the Triassic semi-heterocercal Lepidosteids, to which it has been applied by the Messrs Redfield.

Geological Position and Localities.—From the Calciferous Sandstone series. In ironstone nodules from the shore at Wardie, near Edinburgh; on the shore near Pittenweem, in Fifeshire, in the collection of Mr J. W. Kirkby; in a compact grey limestone at Cornceres near Kilrenny, collected by the late Professor Goodsir.

Rhadinichthys tenuicauda, sp. nov. Traquair.

Length, about 2½ to 3 inches; form slender, narrowly tapering posteriorly. Head bones sculptured externally, with closely set flexuous ridges; dentition not visible. Scales rather large for the small size of the fish, and especially large on the sides of the abdomen, becoming smaller on the back and towards the tail. The posterior margins of the scales are denticulated, their external surfaces nearly smooth along the sides of the body and on the tail pedicle, but along the back, especially between the dorsal fin and the head, they are marked by a few rather prominent oblique ridges; a similar ornamentation, though rather finer and closer in character, makes its appearance also on the scales along the ventral margin. The pectoral fin is small; the non-articulation of its stouter rays seems to prevail over a less extent of the fin than is usual in this genus. The ventral is still smaller. The dorsal and anal are of medium size, and nearly opposite each other; their rays are fine and distantly jointed. Between the anal and caudal fins there is a considerable interval. The caudal is inequilobate, with attenuated body prolongation; its rays are slender, smooth, and with distantly placed articulations. The fulcra are very obvious in all the fins, notwithstanding the small size of the fish.

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* Trans. Geol. Soc. of Edinburgh, vol. ii. pt 1. (1872), p. 124.

Remarks.—This species is allied to *R. carinatus* in general form, and in the large size of the scales of the flank, but differs obviously from it in the general larger proportional size of the scales, in the ornate character of those along the dorsal and ventral margins, and in the greater delicacy of the fins, and smaller number of their rays. The head seems also to be larger in proportion to the size of the fish.

Geological Position and Localities.—A fish of the middle or "Edge Coal" group of the Carboniferous Limestone series, the specimens above described being from Wallyford, near Tranent, in the collections of Mr D. J. Brown; and from Possil, near Glasgow, in the collection of Messrs James Thomson and John Young, F.G.S. To the kindness of these gentlemen I am indebted for the opportunity of describing this most distinct and interesting little form.

On the Cranial Osteology of *Rhizodopsis*, and on some points in the Structure of *Rhizodus*. By Dr R. H. Traquair.

(*Abstract.*)

Read May 21, 1877.

This paper contains an account of the cranial structure of *Rhizodopsis* as far as this can be elucidated by an examination of a suite of specimens from the Coal Measures of Fenton, Staffordshire, in the collection of Mr Ward of Longton, supplemented by additional specimens from various other localities.

The cranial shield of *Rhizodopsis* resembles in general form and structure that of the Saurodipterini, though the surface of the bone is elaborately sculptured instead of presenting the smooth glistening aspect characteristic of the external plates and scales of the last named group. The posterior part of the shield is composed of two elongated *parietals*, and having on its outer margin two smaller plates, anterior and posterior, which may be considered as the *post-frontal* and *squamosal* respectively. The anterior or fronto-ethmoidal portion forms the depressed rounded snout, the front margin of which above the mouth, is formed by two small dentigerous *præmaxillary* bones entirely differing in form from the bones described as such by Messrs Hancock and Atthey. The gape is wide, the *hyomandibular* bone being slightly inclined backwards; there is apparently no *symplectic.* The form of the *maxilla* is well known; the structure of the *mandible* is exceedingly complex. Its dentary element is found to correspond with the bone interpreted by Messrs Hancock and Atthey as "*præmaxilla,*" but turned in a contrary direction, *i.e.*, with its toothed margin upwards instead of downwards as supposed by them; it bears the anterior laniary tooth and the outer row of small teeth. The laniaries posterior to the front one are borne on separate *internal dentary* ossicles, the presence of which is clearly proved by a portion of a jaw of a large specimen of *Rhizodopsis* in the Edinburgh Museum. The external aspect of the lower jaw is completed by at least two *infra-dentary* plates situated below the inferior margin of the dentary, behind which there is another covering externally the articular and angular region of the jaw, and which is probably the equivalent of the *angular* of other ganoids. On the internal aspect of the mandible there is, besides the internal dentary or laniary ossicles, a well-marked *splenial.* The orbit is very anteriorly placed; as in *Megalichthys,* three plates cover the cheek behind the suborbitals, corresponding to the single large one in *Osteolepis.* The author does not find Professor Young's statements that the jugular plates of *Rhizodopsis* are "in two pairs, principal and posterior," and that there is "no trace of median or of lateral plates," corroborated by the specimens under examination. On the other hand, he finds *one pair* of large *principal* jugulars with at least four *lateral* ones on each side, as well as very distinct evidence of the presence of a median plate behind the symphysis of the jaw. The shoulder girdle is provided with well-developed infraclavicular plates.

The lower jaw of *Rhizodus Hibberti* is found to have essentially the same structure as that of *Rhizodopsis.* The dentary element is of the same form, and bears the anterior large laniary tooth and the outer range of small teeth, the posterior laniaries being borne on separate ossicles, which are sometimes found entirely detached.

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Collett (Robert). Norges Fiske med Bemaerkninger om deres Udbredelse. 8vo. Christiania, 1875.—*From the Author.*

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Lagorio (Alexander). Microscopische Analyse Ostbaltischer Gebirgsarten. 8vo. Dorpat, 1876.—*From the Author.*

Le Gras (A.). The Mediterranean Sea: Its Winds, Currents, and Navigation. Translated by R. H. Wyman. 8vo. Washington, 1870.—*From the Translator.*

Lehmann (Th.). Ein Fall von hochgradiger Asphyxie. Inaug. Dissert. Erlangen. 8vo. Leipzig, 1876. — *From the Author.*

Lindsay (The Lord). See Struve (F. G. W.).

Long (Rev. J.). The Eastern Question in its Anglo-Indian Aspect. 8vo. London, 1877.—*From the Author.*

Lymas (G. A.). Wirkung des Salicylsauren Natrons auf den thierischen Organismus. Inaug. Dissert. 8vo. Erlangen, 1876.—*From the Author.*

Macfie (R. A.). The Patent Bill. 8vo. Dreghorn, 1877.—*From the Author.*

Marie (Maximilien). Les périodes cycliques ou logarithmiques de la quadratrice d'une courbe algébrique du degré m sont les products par $2\pi\sqrt{-1}$ des racines d'une équation de degré m. 4to. Paris, 1877.—*From the Author.*

——— Sur les relations entre les périodes de la quadratrice de la courbe la plus générale de degré m et d'une courbe particulière. 4to. Paris, 1877.

——— Sur les deux théorèmes de M. Clebsch relatifs aux courbes quarrables par les fonctions elliptiques ou par les fonctions circulaires. 4to. Paris, 1877.—*From the Author.*

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Mueller (Baron Ferd. von). Select Plants eligible for Culture or Naturalisation in Victoria. 8vo. Melbourne, 1876.—*From the Author.*

Müller (Albert). British Gall-Insects. 8vo. Basle, 1876.

——— On the manner in which the Ravages of the Larvæ of a Nematus on Salix Cinerea are checked by Picromerus Bidens. 8vo. London, 1872.

——— On the Dispersal of Non-migratory Insects by Atmospheric Agencies. 8vo. Basle, 1877.—*From the Author.*

Müller (Professor J. W.). Transfusion und Plethora: eine physiologische Studie. 8vo. Christiania.—*From the Author.*

Mutschler (L.). Ueber Cyclamin, Primulin, u. Primula Camphor. Inaug. Dissert. 8vo. Erlangen.—*From the Author.*

Otten (Ferdinand). Vergleichend histiologische Untersuchung der Sarsaparillen. 8vo. Dorpat, 1876.—*From the Author.*

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Pihlemann (R.). Untersuchungen über die angeblich präformirten Verbindungswege zwischen den Blut u. Lymphgefässen des Frosches. 8vo. Dorpat, 1876.—*From the Author.*

Plantamour (E.) et Wolf (R.). Détermination télégraphique de la différence de longitude entre l'Observatoire de Zurich et les Stations du Pfänder et du Gäbris. 4to. Genève—Bale—Lyon, 1877.—*From the Authors.*

Pleyte (W.). Construction de l'Église Paroissiale de St Jacques à Utrecht. Folio. Leide, 1877.—*From the Author.*

Powell (Baden H.). Handbook of the Economic Products of the Punjab. Vol. I.—Economic Raw Produce. Vol. II.—Manufactures and Arts of the Punjab. 8vo. 1868–72.—*From the Author.*

Ramsay (J.), Stirton (J.). Notes on the Flora of the West of Scotland. 12mo. Glasgow, 1876.—*From the British Association for the Advancement of Science.*

Reade (T. Mellard). On Geological Time. 8vo. Liverpool, 1877. —*From the Author.*

Redeker (P.). Die Elektricität als Heilmittel bei Rückenmarkskrankheiten. Inaug. Dissert. 8vo. Erlangen, 1876.—*From the Author.*

Reynaud (Leonce) and Jenkins (Adm. T. A.). Memoir upon the Lighthouse Illumination of the Coasts of France. 8vo. Washington, 1871.—*From Admiral Jenkins.*

Röhrig (A.). Ueber Achsendrehung der Ovarien. Inaug. Dissert. Erlangen. 8vo. Leipzig, 1876.—*From the Author.*

Roth (M.). Die Seekrankheit. Inaug. Dissert. Erlangen. 8vo. München, 1875.—*From the Author.*

Sander (Alexander). Casuistik der Psychosen. 8vo. Dorpat, 1876.—*From the Author.*

Sars (G. Ossian). On some remarkable forms of animal life from the great deeps off the Norwegian coast. No. 2.—The Genus Brisinga. 4to. Christiania.—*From the Author.*

Saubert (H.). Die Massage; ein wichtiges chirurgisches Hilfsmittel. Inaug. Dissert. Erlangen. 8vo. Ansb., 1876.—*From the Author.*

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Schübeler (Professor F. C.). Die Pflanzenwelt Norwegens. 4to. Christiania.—*From the Author.*

Scotland. The National Manuscripts of Scotland, selected by the Lord Clerk Register, photographed by Sir H. James. Vols. II., III. Folio. Southampton, 1872.—*From the Lord Clerk-Register* (*Sir William Gibson-Craig, Bart.*).

Seve (C. de). Windrosen des Südlicher Norwegens. 4to. Christiania.—*From the Norwegian Meteorological Institute.*

Sorgenfrey (Alexander). Ueber Wiederbelebung und Nachkrankheiten nach Scheintod. 8vo. Dorpat, 1876.—*From the Author.*

Steiner (J.). Das Amerikanische Pfeilgift Curare: Habilitationschrift,—Erlangen. 8vo. Leipzig, 1877.—*From the Author.*

Stroehmberg (Christian). Casuistik der amyloiden Degeneration an den Augenliedern. 8vo. Dorpat, 1877.—*From the Author.*

Struve (F. G. W.) and Lord Lindsay. A summary or index of the measurements in the "Stellarum duplicium et multiplicium mensuræ micrometricæ," the "Synopsis observationum de stellis duplicibus," &c., rearranged and brought up to 1875. (Dunecht Observatory Publications, No. 1.) 4to. Dunecht, 1876.—*From the Lord Lindsay.*

Süss (J.). Catulliana, Th. 1. 8vo. Erlangen, 1876.—*From the Author.*

Teichmüller (Gustav). Festrede zur Jahresfeier der Stiftung der Universität Dorpat. Dec. 1876. 4to. Dorpat, 1877.—*From the Author.*

Teutleben (E. von). Die Tuben-Tonsille des Menschen: Inaugural Abhandlung. 8vo. Leipzig, 1876.—*From the Author.*

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Todaro (Augustino). Hortus Botanicus Panormitanus. Tom. I, Fasc. 1–6. Folio. Panormi.—*From the Author.*

Van Dessel (Camille). L'Établissement Belgo-Romain de Rumpst, 8vo. 1876.—*From the Author.*

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Voitlenlaitner (H.). Ueber Uterusfibroide. Inaug. Dissert. 8vo. Erlangen, 1875.—*From the Author.*

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Wein (E.). Ueber die in Butterfett enthaltenen Fettsäuren. Inaug. Dissert. 8vo. Erlangen, 1876.—*From the Author.*

Wiedemann (Carl). Ueber die Wirkung des Camphors auf den Thierorganismus, und seine Ausscheidung aus demselben. 8vo. Dorpat, 1877.—*From the Author.*

Wilson (Joseph) and Gorgas (A. C.). Naval Hygiene. 8vo. Washington, 1870.—*From the Authors.*

Wittelshöfer (M.). Das Pfandrecht an einer Forderung (pignus nominis). Inaug. Abhandlung. 8vo. Erlangen, 1876.—*From the Author.*

Wolf (R.). See Plantamour (E.).

Young (Professor John). See Armstrong (James).

II. TRANSACTIONS AND PROCEEDINGS OF LEARNED SOCIETIES, ACADEMIES, ETC.

Amsterdam.—Jaarboek van de Koninklijke Akademie van Wetenschappen gevestigd te Amsterdam, voor 1875. 8vo.—*From the Academy.*

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Catalogus van de Boekerij der Koninklijke Akademie van Wetenschappen gevestigd te Amsterdam. Eersten Deels tweede Stuk; tweede Deel; derden Deels eerste Stuk. 8vo. 1860–76.—*From the Academy.*

Appalachia. See *Boston.*

Baltimore.—Tenth Annual Report of the Provost to the Trustees of the Peabody Institute. 8vo. 1877.—*From the Institute.*

Berlin.—Monatsbericht der Königlich Preussischen Akademie der Wissenschaften zu Berlin. Juni–Dec. 1876, Jan.–Mai, 1877.—*From the Academy.*

Berne.—Beiträge zur Geologischen Karte der Schweiz herausgegeben von der Geologischen Commission der Schweiz. Naturforsch. Gesellschaft auf Kosten der Eidgenossenschaft. Lief. 14te. 4to. 1877.—*From the Commission.*

Bologna.—Memorie della Accademia delle Scienze dell' Istituto di Bologna. Serie III. Tomi V., VI. 4to.—*From the Academy*

Rendiconti delle Sessioni dell' Accademia delle Scienze dell' Istituto di Bologna, Anni Accademici 1874–75, 1875–76. 8vo.—*From the Academy.*

Bombay.—The Indian Antiquary. Vol. V. Parts 61–69. 4to.—*From Bombay Education Society.*

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Brussels.—Observations Météorologiques faites aux Stations internationales de la Belgique et des Pays-Bas. Première année, 1877. 4to. Bruxelles.

Bulletin de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique. Tome XLII., Seconde Série, Nos. 9–12. Tome XLII. Nos. 1–5.—*From the Academy,*

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Memoirs of the Geological Survey of India. Vol. XII. Nos, 1, 2. 8vo.—*From the Survey.*

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Cherbourg.—Société Nationale des Sciences Naturelles de Cherbourg. Compte Rendu de la Séance, 30th December 1876. 8vo.—*From the Society,*

Christiania.—Criminalstatistiske Tabeller for Kongeriget Norge for Aarene 1871–73.—*From the Government of Norway.*

Oversigt over det Nordlandske Kirke og Skolefonds Indtægter og Udgifter, i Aaret 1874. 4to.—*From the Government of Norway.*

Christiania.—Tabeller vedkommende Skiftevæsenet i Norge, i Aaret 1871–73. 4to.—*From the Government of Norway.*

Beretninger om Norges Fiskerier, i Aarene 1873–74. Christiana, 1876. 4to.—*From the Government of Norway.*

Det Kongelige Norske Frederiks-Universitets Aarsberetning for 1874–75. 8vo.—*From the University.*

Enumeratio Insectorum Norvegicorum. Auctore, H. Siebke. Edidit J. Sparre' Schneider. Fasc. III., IV. 1876–77. 8vo.—*From the Royal University of Norway.*

Norske Historiske Forening. — Paul Christian Holst: Optegnelser om sit Liv og sin Samtid. Hefte 1, 2. 1875–76. 8vo.—*From the Society.*

Nyt Magazin for Naturvidenskaberne. Bind XXI. Hefte 1–4; Bind XXII. Hefte 1–4. 8vo.—*From the Physiographical Society of Christiania.*

Brandanus Saga: Fragment.—*From the University of Christiania.*

Oversigt over Oplysningsvaesnets Fonds Indtægter og Udgifter i Aaret 1874. 4to.—*From the Government of Norway.*

Uddrag af Consulatberetninger vedkommende Norges Handel og Skibsfart, Aaret 1874. 4to.—*From the Government of Norway.*

Fordhandlinger i Videnskabs-Selskabet i Christiania, Aar 1874, og Aar 1875. 8vo.—*From the Society.*

Norske Universitets- og Skole-Annaler. XIII. Heft 1–4, 1875. 8vo.—*From the University.*

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Kommunale Forholde i Norges Land og Bykommuner, Aarene 1869–71. 4to.—*From the Government of Norway.*

Oversigt over Kongeriget Norges Indtægter og Udgifter, Aaret 1873. 4to.—*From the Government of Norway.*

Tabeller vedkommende Norges Handel og Skibsfart, i Aaret 1874. 4to.—*From the Government of Norway.*

Copenhagen.—Oversigt over det Kongelige Danske Videnskabernes Selskabs Forhandlinger, i Aaret 1876, Nos. 1–3; 1877, No. 1. 8vo.—*From the Society.*

Copenhagen.—Tyge Brahe's Meteorologiske Dagbog holdt paa Uraniborg for Aarene 1582–1597. Udgiven som Appendix til Collect. Meteorologica af Danske Videnskabarnes Selskab. 8vo. Kjöb., 1876.—*From the Society.*

Davenport, Iowa.—Proceedings of the Davenport Academy of Natural Sciences. Vol. I. 1867–1876. 8vo.—*From the Academy.*

Dehra Dun.—General Report on the Operation of the Great Trigonometrical Survey of India, during 1875–76. Folio.—*From the Survey.*

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Personal der Kaiserlichen Universität zu Dorpat. 8vo. 1876.—*From the University of Dorpat.*

Dresden.—Nova Acta Academiæ Cæsareæ Leopoldino-Carolinæ Germanicæ Naturæ Curiosorum. Vols. XXXVII., XXXVIII. 4to.—*From the Academy.*

Leopoldina: Amtliches Organ der Kaiserlichen Leopoldinisch-Carolinishen Deutschen Akademie der Naturforscher. Hefte 10, 11. 4to.—*From the Academy.*

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Proceedings of the Royal Irish Academy (Polite Literature). Series II. Vol. I. No. 11; (Science) Vol. II. Nos. 4–6. 8vo.—*From the Academy.*

Edinburgh.—Annual Reports of the Council of the Royal Scottish Academy of Painting, Sculpture, and Architecture. 8vo. 1876.—*From the Academy.*

Catalogue of the Printed Books in the Library of the Faculty of Advocates. Vol. V. 4to. Edinburgh, 1877. —*From the Library.*

Transactions of the Highland and Agricultural Society of Scotland. Vol. IX. 8vo. 1877.—*From the Society.*

Transactions of the Scottish Arboricultural Society. Vol. VIII. Part 2. 1877.—*From the Society.*

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Frankfort.—Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft. Band XI. Heft 1. 4to. 1877.—*From the Society.*

Bericht über die Senckenbergische Naturforschende Gesellschaft. 8vo. 1875–76.—*From the Society.*

Geneva.—Mémoires de la Société de Physique et d'Histoire Naturelle de Genève. Tome XXIV. Part 2. 4to.—*From the Society.*

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Leipzig.—Sitzungsberichte der Naturforschenden Gesellschaft. Jahrg. I., II., III., IV., No. 1. 8vo. 1874–77.—*From the Society.*

Liverpool.—Transactions of Historic Society of Lancashire and Cheshire. Third Series. Vols. III., IV. Sessions 1874–75, 1875–76. 8vo.—*From the Society.*

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A Catalogue of the Books in the Admiralty Library. By R. Thorburn, Librarian. 4to. London, 1875.—*From the Lords Commissioners of Admiralty.*

Transactions of the Society of Antiquaries. Vol. XLIV. Part 2 ; Vol. XLV. Part 1. 4to.—*From the Society.*

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Transactions of the Linnean Society. Second Series (Botany), Vol. I. Part 4; Second Series (Zoology), Vol. I. Part 4. 4to. 1876.—*From the Society.*

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Publications du Depôt de la Marine (avec Cartes). 8vo.—*From the Depôt.*

Recherches sur les Chronomètres et les Instruments nautiques, par E. Caspari. 11^e Cahier. 8vo. Paris, 1876.—*From the Depôt de la Marine.*

Mer du Nord. 3^e partie. Côtes d'Angleterre. 8vo. Paris, 1876.—*From the Depôt de la Marine.*

Annuaire des Marées de Cochin Chine. 12mo, 1877.—*From the Depôt de la Marine.*

Annales de Mines. Tome X. Liv. 4–6.—*From the École des Mines.*

Mémoires de l'Académie des Sciences de l'Institut de France. Tomes XXIX. (1867); XXXII. (1864); XXXIV. (1864); XXXV. (1866); XXXVI. (1870); XXXVII. Part 1 (1868), Part 2 (1870); XL. (1876); XLI. Part 2 (Recueil des Mémoires du Passage de Vénus), 1876.

Paris.—Mémoires présentés à l'Académie des Sciences de l'Institut de France. Tomes XVIII. (1868); XIX. (1865); XX. (1872); XXI. (1875); XXII. (1876).—*From the Institute.*

Annales Hydrographiques. 1876. Nos. 2, 3. 8vo.—*From the Depôt de la Marine.*

Bulletin de la Société Géographique. December, 1876 Jan.–Juin, 1877. 8vo.—*From the Society.*

Comptes-Rendus Hebdomadaires des Séances de l'Académie des Sciences. 1876, Jan.–Juillet, 1877. 4to.—*From the Academy.*

Philadelphia.—Journal of the Academy of Natural Sciences. New Series. Vol. VIII. Part 2. 8vo.—*From the Academy.*

Proceedings of the Academy of Natural Sciences. 4to. 1876.—*From the Academy.*

Proceedings of the American Philosophical Society. Vol. XV. No. 96; XVI. No. 98. 8vo.—*From the Society.*

Fourth and Fifth Annual Reports of the Zoological Society of Philadelphia. 8vo. 1876, 1877.—*From the Society.*

Pulkowa.—See *St Petersburg.*

Rome.—Bollettino del Comitato Geologico d'Italia. Nos 11, 12. Nov. e Dec. 1876.—*From the Society.*

Atti della R. Accademia dei Lincei 1876–77. Serie 2da. Vol. I., II., III., Pti. 1, 2, 3. Serie 3za. Vol. I. Transunti, Fas 1–6.—*From the Academy.*

Salem (*U.S.*)—Bulletin of the Essex Institute. Vols. VII., VIII. 8vo. 1876.—*From the Institute.*

Steiermark.—See under *Gratz.*

Stockholm.—Meteorologiska Jakttagelser i Sverige utgifna af Köngl. Svenska Vetenskaps-Akademiens anställda och bearbetade af Ei-Edlund. Bandet 1873. 4to.—*From the Academy.*

Voyage autour du Monde sur la Frégate Suédoise l'Eugénie pendant 1851–53. Observations scientifiques publiées par l'Académie Royale des Sciences à Stockholm, Physique, III. 4to. 1874.—*From the Swedish Government.*

St Petersburg.—Annalen des Physikalischen Central-Observatoriums. 8vo. 1875.—*From the Russian Government.*

Memoires de l'Académie Impériale des Sciences de St-Pétersbourg. Série vii. Tomes XXII. 11, 12; XXIII., XXIV. —*From the Academy.*

St Petersburg.—Bulletin de l'Académie Impériale des Sciences de St-Pétersbourg. Tomes XXII., XXIII. 4to.—*From the Academy.*

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Turin.—Memorie della Reale Accademia delle Scienze di Torino. Serie Seconda. Tomo XXVIII. 4to. 1876.—*From the Academy.*

Upsala.—Bulletin Météorologique Mensuel de l'Observatoire de l'Université. Vol. VII. 4to.—*From the University.*

Nova Acta Regiæ Societatis Scientiarum Upsaliensis. Vol. X. Fasc. 1. 4to.—*From the Society.*

Utrecht.—Aanteekeningen van het Verhandelde in de Sectie-Vergaderingen van het Provinciaal Utrechtsch Genootschap van Kunsten en Wetenschappen, 1875, 1876. 8vo. —*From the Society of Science and Art.*

Verslag van het Verhandelde in de algemeene Vergadering van het Provinciaal Utrechtsch Genootschap van Kunsten en Wetenschappen, 1875, 1876. 8vo.—*From the Society.*

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Nederlandsch Meteorologisch Jaarboek, 1875. 4to.—*From the Meteorological Institute.*

Venice.—Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti. Serie v. Tom. I., II., III. 1, 2, 3. 1874–75, 1875–76. *From the Institute.*

Victoria (*Australia*).—Victorian Yearbook for 1875, by H. H. Hayter.—*From the Australian Government.*

Statistics of the Colony, 1873–77. Agricultural Statistics, 1877. Vital Statistics, &c.—Part 8. Patents and Patentees—Vol. VIII., 1873. Statistical Register of the Colony of Victoria for 1875. Folio. Abstracts of Specifications of Patents—Part 2, Sect. 1 : Metals. 4to. Statistics of Friendly Societies, 1875.—*From the Registrar-General.*

Transactions and Proceedings of the Royal Society of Victoria. Vols. XI., XII. 8vo. 1876.—*From the Society.*

Vienna.—Geologie der Kaiser Franz Josefs Hochquellen-Wasserleitung. Eine Studie in den Tertiär-Bildungen am Westrande des Alpinen Theiles der Niederung von Wien, von Felix Karrer. 4to. Wien, 1877.—Abhundlungen der k. k. Geologischen Reichsanstalt. Band IX. 4to.—*From the Society.*

Denkschriften der kaiserlichen Academie der Wissenchaften. Math.-Natur. Classe—Band XXXVI. Phil.-Hist. Classe—Bände XXIV., XXV. 4to. 1876.—*From the Academy.*

Sitzungsberichte der kaiserlichen Academie der Wissenschaften. Min.-Bot.-Zool. Geo.-Pal.-Classe—Band LXXII. Physiol.-Anat. Classe—Band LXXI. Hefte 3, 4, 5; LXXII. Hefte 1–5. Phil.-Hist. Classe—Band LXXX. Heft 4; LXXXI; LXXXII. Hefte 1, 2. Math.-Nat. Classe—Band LXXII. Hefte 1–5. 8vo. — *From the Academy.*

Almanach der kaiserlichen Academie der Wissenschaften. 1876. 8vo.—*From the Academy.*

Jahrbuch der kaiserlich-königlichen Geologischen Reichsanstalt. Band XXVI. Nos. 3, 4; XXVII. No. 1. 8vo. 1877.—*From the Society.*

Verhandlungen der kaiserlich-königlichen Geologischen Reichsanstalt. Nos. 1–4, 1876, 1877. 8vo.—*From the Society.*

Verhandlungen der kaiserlich-königlichen zoologish-botanischen Gesellschaft in Wien. Band XXVI. 8vo.—*From the Society.*

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A Monograph of the Geometrid Moths or Phalænidæ of the United States, by A. S. Packard, jr., M.D. Vol. X. 4to. Washington, 1876.—*From the United States Government.*

Bulletin of the Entomological Commission. Nos. 1, 2. 8vo. 1877.—*From the United States Government.*

Preliminary Report of the U.S. Geological Survey of Wyoming and contiguous Territories. Conducted by F. V. Hayden, 1870. 8vo. Washington, 1871.—*From the United States Geological Survey.*

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Schweizerische Meteorologische Beobachtungen herausgegeben von der Meteorologischen Centralanstalt der Schweizerischen Naturforschenden Gessellschaft. Lief. 2–5. Jahrg. XIII., 1855; Jahrg. XVI., 1858. 4to. 1876.—*From the Society.*